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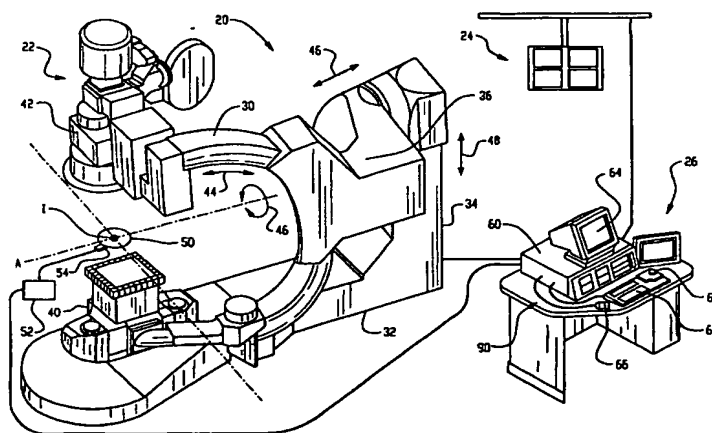
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ROTATIONAL ANGIOGRAPHY BASED HYBRID 3-D RECONSTRUCTION OF CORONARY ARTERIAL STRUCTURE



(57) Abstract: A method and apparatus of generating a hybrid three dimensional reconstruction of a vascular structure affected by periodic motion comprises placing an object (50) affected by periodic motion to be imaged in an imaging region of an x-ray system 22, the object having a vascular structure. At least two x-ray images of the vascular structure are acquired (104, 204). Indicia of the phases of periodic motion are obtained (104, 52) and are correlated with each of the x-ray images. At least two x-ray images from a similar phase of periodic motion are selected (108). A three dimensional modeled segment of a region of interest in the vascular structure is generated (110, 210), the modeled segment reconstructed using the selected x-ray images from a similar phase of periodic motion and the region of interest only a portion of the imaged vascular structure. A three dimensional volumetric reconstruction of a vascular structure is generated (112, 212, 207) that is larger than the modeled segment. The modeled segment of interest (148) and the volumetric reconstruction of the larger vascular structure are combined and displayed (220) in human readable form.

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B6/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61B G06T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/41780 A (PHILIPS MEDICAL SYSTEMS, INC.) 30 May 2002 (2002-05-30) page 4, line 25 - page 10, line 27 figures	1-5, 10-15, 17,20-24
A	----- WO 01/085030 A (PAIEON INC.) 15 November 2001 (2001-11-15) page 8, line 2 - page 11, line 11 figures	1,10,17
A	----- US 5 293 574 A (ROEHM ET AL.) 8 March 1994 (1994-03-08) column 3, line 63 - column 6, line 8 column 8, line 11 - line 47 ----- -/--	1,10,17

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
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- "O" document referring to an oral disclosure, use, exhibition or other means
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- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/17719

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 090 586 A (GENERAL ELECTRIC COMPANY) 11 April 2001 (2001-04-11) page 3, line 25 - page 5, line 14; figures 1-5 -----	1,3,6, 8-10,12, 15, 17-19, 21,24
A	WO 02/36011 A (KONINKLIJKE PHILIPS ELECTRONICS N.V.) 10 May 2002 (2002-05-10) cited in the application the whole document -----	1,3,6,8, 10,12, 15,18, 21,24

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 03/17719

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-6, 8-5, 17-24

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-6,8-15,17-24

Generating a hybrid three dimensional reconstruction of a vascular structure affected by periodic motion.

1.1. claims: 8,9,18,19

Determining scan speed and duration.

2. claims: 7,16,25

Computation of a blood vessel overlap map.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 03/17719

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
WO 0241780	A	30-05-2002	US	6473634 B1	29-10-2002
			EP	1365685 A2	03-12-2003
			WO	0241780 A2	30-05-2002

WO 0185030	A	15-11-2001	AU	3596401 A	20-11-2001
			EP	1280459 A1	05-02-2003
			WO	0185030 A1	15-11-2001
			US	2003078500 A1	24-04-2003

US 5293574	A	08-03-1994	DE	69332674 D1	13-03-2003
			DE	69332674 T2	18-12-2003
			EP	1158465 A1	28-11-2001
			EP	0606709 A2	20-07-1994
			JP	6217968 A	09-08-1994

EP 1090586	A	11-04-2001	US	6639965 B1	28-10-2003
			EP	1090586 A2	11-04-2001
			JP	2001137232 A	22-05-2001

WO 0236011	A	10-05-2002	WO	0236011 A1	10-05-2002
			EP	1330186 A1	30-07-2003
			US	2002126794 A1	12-09-2002
